19.   (Amended) The method of claim 18 wherein organizing the plurality of disks comprises organizing the plurality of disks into a plurality of RAID sets.

20.   (Amended) The method of claim 19 wherein organizing the plurality of disks comprises organizing the plurality of disks into a plurality of RAID-5 sets.

REMARKS

Informalities

The claims have been amended to address the various informalities raised by the Examiner. Applicant notes that the claim amendments neither necessitate an additional search nor raise new grounds for objection. Therefore, the claim amendments made herein do not provide grounds for a final rejection.

Rejections Under 35 U.S.C. § 102(b)

Applicant traverses the rejection of claims 1, 2, 4, 6, 8,and 13-15 under 35 U.S.C. § 102(b) as allegedly being anticipated by Massiglia, The RAID Book (Massiglia).   The identical rejection was issued in the Office Action mailed March 19, 2001, and was overcome by the amendments and arguments made in the Amendment submitted June 19, 2001. The Examiner conceded this rejection was improper in the Office Action mailed September 10, 2001 by withdrawing the rejection under 35 U.S.C. § 102(b) and issuing a rejection under 35 U.S.C. § 103(a).   In the Office Action, the Examiner conceded:

> Massiglia does not explicitly disclose a plurality of
> back-end controllers.

The Examiner has provided no basis for the reinstatement of this previously withdrawn rejection under 35 U.S.C. § 102(b).   Therefore, Applicant submits that the rejection is improper and should be withdrawn.

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Rejections under 35 U.S.C. § 103(a)

1.   Rejection of Claims 3 and 17

Applicants traverse the rejection of claims 3 and 17 under 35 U.S.C. § 103(a) as allegedly being obvious over Massiglia in view of U.S. Patent No. 6,330,687 to Griffith ('687 patent).   The rejection is improper because, as noted above, the Examiner has already conceded that Massiglia does not show a plurality of back end controllers.   Therefore, Massiglia, alone or in combination with the '687 patent, neither discloses nor suggests an apparatus containing each limitation recited in claim 3 or a method containing each step recited in claim 17. In re Royka, 490 F.2d 981 (CCPA 1974).

2.   Rejection of Claims 5, 7, and 16

Applicants traverse the rejection of claims 5, 7, and 16 under 35 U.S.C. § 103(a) as allegedly being obvious over Massiglia. The rejection is improper because, as noted above, the Examiner has already conceded that Massiglia does not show a plurality of back end controllers. Therefore, Massiglia, can neither disclose nor suggest an apparatus having each of the limitations recited in claims 5 and 7, or a method having each step recited in claim 16. In re Royka, 490 F.2d 981 (CCPA 1974).

3.   Rejection of Claims 9, 11-12, and 18-20

Applicants traverse the rejection of claims 9, 11-12, and 18-20 under 35 U.S.C. § 103(a) as allegedly being obvious over Massiglia in view of U.S. Patent No. 5,611,069 to Matoba ('069 patent). As noted above, the Examiner has conceded that Massiglia neither discloses nor suggests a plurality of back-end controllers, as recited in independent claims 8 and 18. Further, the '069 patent neither discloses or suggests a plurality of back-end controllers. Therefore, the combination of Massiglia and the '069 patent fails to disclose or suggest each limitation of claims 9, 11-12, and 18-20. In re Royka, 490 F.2d 981 (CCPA 1974).

In addition, Applicants traverse the rejection of claims 9, 12, and 18-20 because there is no motivation to combine Massiglia and the '069 patent to derive a front end controller for forming mirror sets. There is no suggestion to combine in either Massiglia or the '069 patent.   To the contrary, Massiglia

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clearly teaches segregating the functions of striping and mirroring, which teaches away from implementing a local front-end controller striping RAID sets, as recited in claim 9. The Examiner appears to assert that one of ordinary skill in the art would recognize that Massiglia's architecture suffers from an inherent defect in that if the mirroring array management function fails, then the system would be rendered incapable of mirroring. Therefore, the Examiner asserts that one of ordinary skill in the art would be motivated to combine Massiglia and the '069 patent such that the Striping Array Management Function described in Massiglia also performs mirroring.

Applicants disagree and asserts that one of ordinary skill in the art would not be motivated to combine Massiglia with the '069 patent. The Examiner's argument overlooks the fact that mirroring was well known when Massiglia published. If the defect in Massiglia's architecture was obvious, then Massiglia, who clearly was one of ordinary skill in the art, would have noticed the defect and suggested that the Striping Array Management Function may also perform mirroring functions. Massiglia does not suggest this because, as noted above, Massiglia clearly teaches away from implementing a mirroring function in the Striping Array Management Function.

In sum, there is no motivation to combine Massiglia with the '069 patent because Massiglia teaches away from the present invention. Further, the combination of Massiglia with the '069 patent still fails to teach every element of claims 9, 12, and 18-20. Therefore, the rejection of these claims is improper and should be withdrawn.

Regarding the rejection of claim 20, Applicants agree that Massiglia does not explicitly disclose organizing a plurality of disks into a plurality of RAID-5 sets, as recited in claim 20. Applicants disagree that it would have been obvious to one of ordinary skill in the art, based upon a review of Massiglia, to organize the plurality of disks into a plurality of RAID-5 sets. RAID-5 was known to one of ordinary skill in the art at the time Massigilia was published. If in fact this were obvious, then Massiglia, who is at least of ordinary skill in the art, would have recognized this and disclosed the use of RAID-5.

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Conclusion

In view of all of the above, claims 1-20 are believed to be allowable and the case in condition for allowance which action is respectfully requested. Should the Examiner be of the opinion that a telephone conference would expedite the prosecution of this case, the Examiner is requested to contact Applicants' attorney at the telephone number listed below.

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page is captioned "Version with Markings to Show Changes Made."

No fee is believed due for this submittal. However, any fee deficiency associated with this submittal may be charged to Deposit Account No. 50-1123.

Respectfully submitted,

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IN THE CLAIMS:

Claims 1, 3-6, 8, 11, and 13-20 have been amended as follows:

1.   (Amended)   An apparatus for providing a virtual volume, the apparatus comprising:

a plurality of disks;

a plurality of back-end controller coupled to the <u>plurality of</u> disks for organizing and presenting the <u>plurality of</u> disks as a plurality of redundant arrays of disks; and

a front-end controller coupled to the plurality of back-end controller for striping the <u>plurality of</u> redundant arrays of disks and presenting the striped arrays as a virtual volume.

2.   The apparatus of claim 1 wherein the plurality of disks includes one or more spare disks.

3.   (Amended)   The apparatus of claim 1 wherein the <u>plurality of</u> back-end controller<u>s each</u> include[s] <u>a</u> plurality of busses, each coupled to one and only one of the disks associated with each of the <u>plurality of</u> redundant arrays of disks.

4.   (Amended)   The apparatus of claim 1 wherein the <u>plurality of</u> back-end controller<u>s</u> comprises a RAID engine for presenting the <u>plurality of</u> disks as a plurality of RAID sets.

5.   (Amended)   The apparatus of claim 4 wherein the RAID engine comprises a RAID engine for presenting the <u>plurality of</u> disks as a plurality of RAID-5 sets.

6.   (Amended)   An apparatus for providing a virtual volume, the apparatus comprising:

a plurality of disks;

a redundant array of independent disks (RAID) engine comprising a plurality of back-end controllers coupled to the <u>plurality of</u> disks for organizing and presenting the <u>plurality of</u> disks as a plurality of RAID sets; and

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a striping engine coupled to the RAID engine for receiving the plurality of RAID sets as members, striping the member RAID sets, and presenting the striped member RAID sets as a virtual volume.

7.   The apparatus of claim 6 wherein the RAID engine comprises a RAID-5 engine.

8.   (Amended) An apparatus for providing a virtual volume, the apparatus comprising:

a plurality of back-end controllers, each configured to organize and present X N-member RAID sets, and each having N busses capable of supporting X+1 disks each;

a plurality of groups of X+1 disks, wherein each disk in the group [being] is coupled to one of the N busses associated with one of the plurality of back-end controller busses; and

a local front-end controller coupled to the plurality of back-end controllers for receiving the X N-member RAID sets as members, striping the X N-member RAID sets, and presenting the striped X N-member RAID sets as a virtual volume.

9.   The apparatus of claim 8 wherein the local front-end controller is configured to generate mirror sets from the RAID sets received as members from different back-end controllers, to stripe the mirror sets, and to present the striped mirror sets as the virtual volume.

10.   The apparatus of claim 8 wherein the plurality of back-end controllers includes primary local, redundant local, cloning, primary remote, and redundant remote back-end controllers.

11.   (Amended) The apparatus of claim 8 further comprising a remote front-end controller coupled to at least some of the plurality of the back-end controllers for receiving RAID sets as members, striping the member RAID sets, and presenting the striped member RAID sets as the virtual volume.

12.   The apparatus of claim 11 wherein the remote front-end controller is configured to generate mirror sets from the received RAID sets, to stripe the mirror sets, and to present the striped mirror sets as the virtual volume.

13. (Amended) An electronic system comprising:

a computer; and

an apparatus coupled to the computer for presenting a virtual volume to the computer, the apparatus including:

a plurality of disks;

a plurality of back-end controller coupled to the plurality of disks for organizing and presenting the plurality of disks as a plurality of redundant arrays of disks; and

a front-end controller coupled to the plurality of back-end controllers for striping the plurality of redundant arrays of disks and presenting the striped redundant arrays of disks as the virtual volume.

14. (Amended) A method of storing data on a plurality of disks, the method comprising:

using a plurality of back-end controllers, organizing the plurality of disks into a plurality of redundant arrays of disks;

using at least one front-end controller, striping the plurality of redundant arrays of disks together to form a virtual volume; and

writing the data to the virtual volume.

15. (Amended) The method of claim 14 wherein [the act] of organizing the plurality of disks comprises organizing the plurality of disks into a plurality of RAID sets.

16. (Amended) The method of claim 15 wherein [the act] of organizing the plurality of disks comprises organizing the plurality of disks into a plurality of RAID-5 sets.

17. (Amended) The method of claim 14 wherein [the act] of organizing the plurality of disks includes:

providing one or more back-end controllers, each having a plurality of busses; and

coupling the plurality of disks to the one or more back-end controller busses so that each bus is coupled to no more than one disk from each of the plurality of redundant arrays of disks and each bus is coupled to a spare disk.

18.   (Amended) A method of storing data on a plurality of disks, the method comprising:

using a plurality of back-end controllers, organizing the <u>plurality of</u> disks into a plurality of redundant arrays of disks;

using at least one front-end controller, forming mirror sets from the <u>plurality of</u> redundant arrays of disks;

using at least one front-end controller, striping the mirror sets together to form a virtual volume; and

writing the data to the virtual volume.

19.   (Amended)   The method of claim 18 wherein [the act] of organizing the <u>plurality of</u> disks comprises organizing the <u>plurality of</u> disks into a plurality of RAID sets.

20.   (Amended)   The method of claim 19 wherein [the act] of organizing the <u>plurality of</u> disks comprises organizing the <u>plurality of</u> disks into a plurality of RAID-5 sets.